

THEORY OF OPERATION

The 80K-40 High Voltage probe, is designed to extend the voltage measurement range of an ac/dc voltmeter up to 40,000 volts. Electrically, the probe is a passive attenuator as shown in Figure 1. Its high input impedance (1000 M Ω), as well as its accuracy and stability characteristics are achieved through the use of special metal film resistors. When the probe is connected to a voltmeter with a 10 M Ω input resistance the probe becomes an accurate 1000:1 divider. Notice that the divider depends upon a ground lead to complete the low side of the circuit path. Therefore, this connection must always be secure before attempting a voltage measurement. Otherwise, instrument damage or a shock hazard will result.

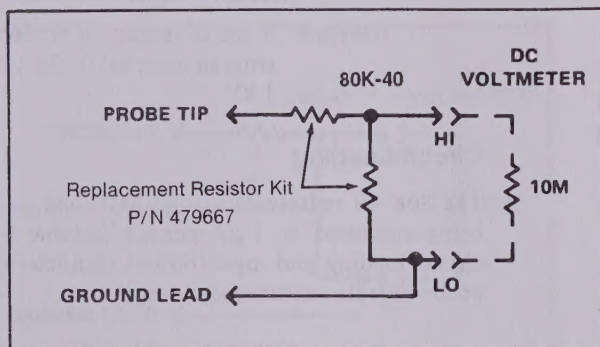


Figure 1. 80K-40 Simplified Circuit Diagram

MAINTENANCE

Performance Test

Verify the probe accuracy by measuring a 25 kV dc $\pm 0.25\%$ voltage source. When used with a compatible dc voltmeter, the probe should measure the source with $\pm 1\%$ accuracy. No calibration adjustments are provided.

Cleaning

Use a soft cloth dampened in distilled water to clean the 80K-40. Never use solvents or abrasive cleaners.

New Cable # 449512 \$ 23.50

To order replacement parts, call 1-800-526-4731. Outside U.S.A. contact your nearest service center.

For application or operation assistance or information on Fluke products, call:

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FLUKE®

Instruction Sheet

80K-40

High Voltage Probe

INTRODUCTION

The Model 80K-40 is a high voltage accessory probe designed to extend the voltage measuring capability of an ac/dc voltmeter up to 40,000 volts. The probe is a precision 1000:1 voltage divider formed by two matched metal-film resistors. The unusually high input impedance offered by these resistors minimizes circuit loading and thereby, optimizes measurement accuracy. A special plastic body houses the divider and provides the user with isolation and protection from the voltage being measured.

SPECIFICATIONS

The 80K-40 will achieve rated accuracy when used with a 0.25% voltmeter (ac or dc) having an input impedance of 10 M $\Omega \pm 10\%$. Specifications for the probe are as follows:

***Voltage Range** 1 kV to 40 kV dc or peak ac, 28 kV rms ac

Input Resistance 1000 M Ω

Division Ratio 1000:1 (1000X attenuator)

Accuracy DC

Overall Accuracy 20 kV to 30 kV $\pm 1\%$

Upper Limit Changes linearly from 1% at 30 kV to 2% at 40 kV

Lower Limit Changes linearly from 1% at 20 kV to 2% at 1 kV

Accuracy AC Typical 1% lower than DC accuracy at 60 Hz

* This probe is intended for low energy applications such as CRT and similar circuits. It may be used in other circuits where the transient overvoltage due to lightning or load switching is limited 80 kV peak. Above 2000 meters altitude, and up to 5000 meters, derate working voltage from 40 kV peak to 28 kV peak, and derate the transient overvoltage from 80 kV peak to 57 kV peak. Transient overvoltage refers to micro-second duration impulses caused by lightning or load switching. See International Electrotechnical Commission Publication 664-1980, Clause 3.9 Table II, and Appendix A.

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MEASUREMENT CONSIDERATIONS

Before attempting to use the 80K-40, the following paragraphs should be read and understood. Particular attention should be given to Operator Safety.

Operator Safety

 Indicates the operator must refer to an explanation in this manual.

 Indicates terminals at which dangerous voltages may exist.

WARNING

TO AVOID DAMAGE OR ELECTRIC SHOCK, USE WITHIN RATINGS AND UNDER DRY (NO CONDENSATION) CONDITIONS.

To avoid electrical shock, the 80K-40 user should be familiar with, and exercise, all possible high-voltage safety practices. When handling the probe the following additional cautions must be taken:

WARNING

- When making a measurement, never make body contact with the probe tip or the red portion of the probe. Always hold the probe by its black handle.
- Before making a measurement, make sure that the tab side of the output connector is connected to the voltmeter's low input terminal.
- The clip lead is intended to be grounded. To avoid electrical shock, attach the grounding clip to potentials below 30V AC, 42 volts peak, or 60V DC.

Voltmeter Compatibility

The 80K-40 is compatible with any ac or dc voltmeter that has an input impedance of $10\text{ M}\Omega \pm 10\%$. Voltmeters with other input impedances require the use of an external shunt or a correction factor to obtain an accurate measurement. Higher impedance voltmeters should be equipped with a shunt, and lower impedance voltmeters should be assigned correction factors. Applicable formulas follow:

- a. The following formula is used to determine the value of an external shunt resistor:

$$R_s = \frac{R_m \times 10\text{ M}\Omega}{R_m - 10\text{ M}\Omega}$$

where: R_s = Shunt resistance in $\text{M}\Omega$

R_m = Voltmeter input impedance in $\text{M}\Omega$
($>10\text{ M}\Omega$)

Example: If $R_m = 100\text{ M}\Omega$,

$$R_s = \frac{100 \times 10}{100 - 10} = \frac{1000}{90} = 11.1\text{ M}\Omega$$

- b. Use the following formula to calculate a correction factor.

$$C_f = \frac{1.11 + R_m}{1.11 \times R_m}$$

Where: C_f = Correction factor (multiplier for meter reading)

R_m = Voltmeter input impedance in $\text{M}\Omega$

Example: If $R_m = 1\text{ M}\Omega$,

$$C_f = \frac{1.11 + 1}{1.11 \times 1} = \frac{2.11}{1.11} = 1.901$$

Therefore: A meter reading of 0.526 volts represents an input of: $0.526 \times 1.901 = 1$ or 1 kV

Circuit Loading

The 80K-40 represents a $1000\text{ M}\Omega$ load to the circuit being measured, or $1\text{ }\mu\text{A}$ per 1 kV. Table 1 shows the circuit loading and input/output characteristics of the probe over its measurement range.

Table 1. 80K-40 Circuit Loading and Input/Output Characteristics

Input Voltage	Loading Current	Output Voltage
10V	10 nA	10 mV
100V	100 nA	100 mV
1 kV	1 μA	1V
10 kV	10 μA	10V
20 kV	20 μA	20V
30 kV	30 μA	30V
40 kV	40 μA	40V

OPERATION

Use the following procedure to operate the 80K-40:

1. Select and energize a compatible voltmeter.
2. Equip the voltmeter with a suitable shunt, if required.
3. Select an appropriate voltage range (1 volt reading per 1000 volt input. See Table 1).
4. Connect the probe's output leads to the voltmeter input terminals.
5. Connect the probe's clip lead to ground. See OPERATOR SAFETY.
6. Connect probe tip to circuit being measured and observe voltmeter reading. Apply correction factor to reading when necessary.

